THE REPRODUCTION AND LIFE HISTORY OF *MICROGINELLA MINUTISSIMA* (TENISON-WOODS, 1876) (GASTROPODA: MARGINELLIDAE)

By Florence V. Murray
Honorary Associate in Invertebrates

Abstract

M. minutissima inhabits *Amathia biseriata,* a colonial polyzoan on which it carries out its life cycle. Spawning takes place throughout the year. Tough-walled, transparent egg capsules are deposited singly on the stem of the host substrate; each contains one red-coloured egg which is irregularly tubular in shape when new-laid but becomes spherical prior to cleaving. After an embryonic period of six to seven weeks a well-developed juvenile crawls from the capsule which breaks open dorsally.

Some observations on the living animal and its behaviour are included.

Introduction

Approximately 200 species of Marginellidae have been recorded from Australian seas: they are nearly all small, often minute, rarely over 5 or 6 mm; the majority are white and highly polished (Laseron 1957). In recent years increasing interest has been shown in the taxonomy of the group, but as little attention has been given to the living animals, life histories or reproductive patterns, the present study was undertaken to help meet this deficiency.

The opportunity to carry out the work was provided by Mrs Jeanette Watson of the Underwater Research Group of Victoria, who while diving in Westernport Bay noticed this small mollusc living in abundance on colonies of the polyzoan, *Amathia biseriata* Krauss 1837, and who kindly collected samples for me over a period of two years. The first of these came from 13 m of water near Eagle Rock, in February 1967, and carried eggs at various stages of development, juveniles and adults, thus indicating the life history pattern and initiating the observations recorded in the following pages.

Genus **Microginella** Laseron, 1957

Microginella minutissima (Tenison-Woods, 1876)

Marginella minutissima Tenison-Woods 1876, *Pap. Proc. Roy. Soc. Tas.,* p. 27.
Marginella pumilio Tate & May 1901, *Proc. Linn. Soc. N.S.W.* 26: 363.
Microginella pumilio Macpherson & Gabriel 1962, Marine Molluscs of Victoria, p. 229.

The species was described by Tenison-Woods from a single specimen, the holotype, which was dredged by the Rev. H. D. Atkinson at 6 fm in Long Bay, D'Entrecasteaux Channel, Tasmania, and is in good condition today. It is housed in the Tasmanian Museum, Hobart, Reg. no. E661/8002 (TM5327).

The name *minutissima* was superseded in 1901 by *pumilio* Tate & May, but reverts back to *minutissima* in view of the following data kindly supplied by Dr W. F. Ponder of the Australian Museum, Sydney:

> 'Tate & May (1901) erected *pumilio* stating that there was a prior *minutissima* Michelin but did not give any date or reference for Michelin's species. Fortunately Tate & May's proofs for their paper are available here and on it is crossed out after Michelin "Gen Rissoa". The full reference to this is Descr. genre Rissoa, 1830, p. 17, and *minutissima* is described as a *Rissoa.* It appears as though there has been an unfortunate error on the part of the authors or

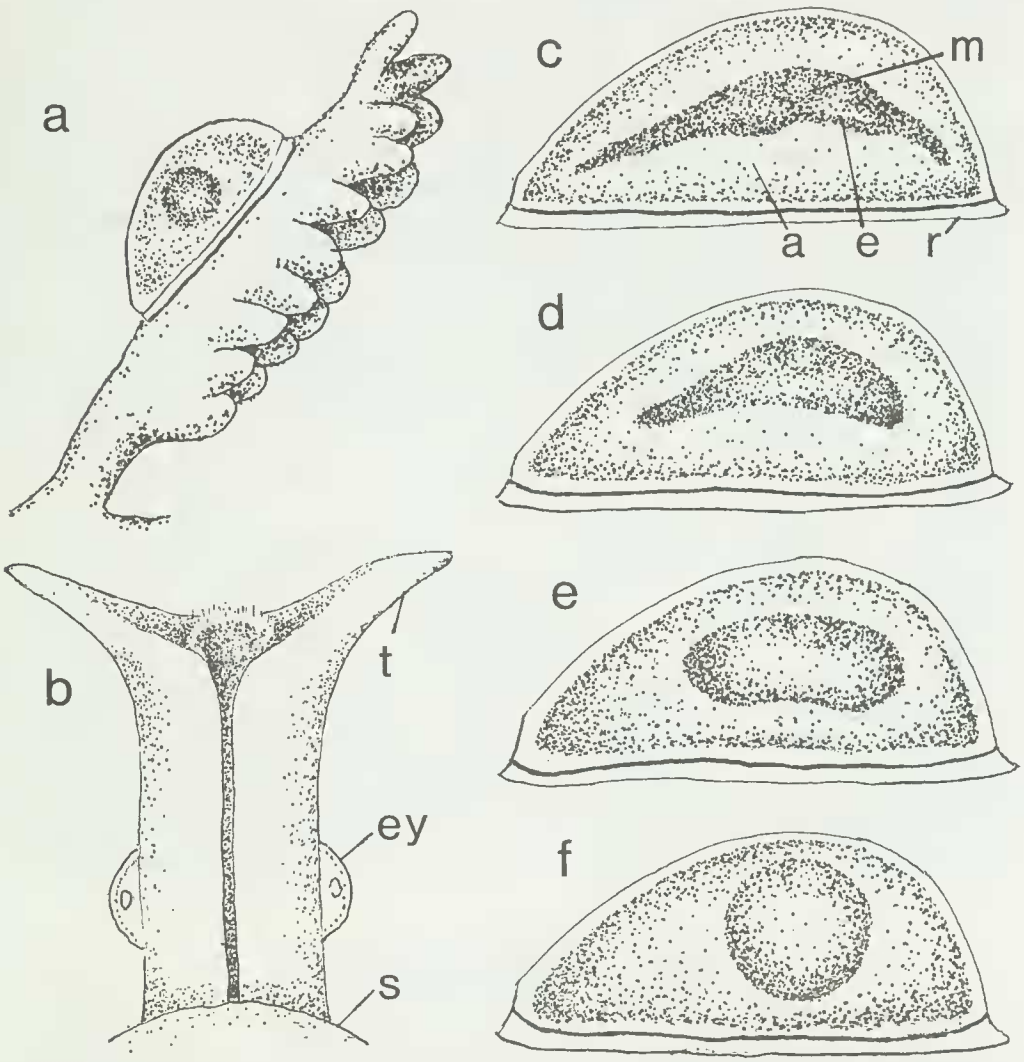

FIG. 1—a. Egg capsule of *M. minutissima* on stem of *A. biseriata*. b. The head/siphon (Dorsal view). c. Egg capsule containing a new-laid egg. d. Same egg four hours after laying. e. *Same* six hours after laying. f. *Same* eight hours after laying.
Abbreviations: a, albumen sac; e, egg; ey, eye; m, micropyle; r, rim; s, edge of shell; t, tentacle.

the capsule (Fig. 1a). The spawning rate appeared to vary with individual females but could be assessed as averaging one egg every 2± days.

The egg, when first seen after deposition, appears as a long, uneven, red-coloured tube, narrow at the ends and broadening towards the central portion where a micropyle is conspicuous (Fig. 1c). This tubular egg-structure soon begins to re-form and continually changes in shape until it becomes spherical: four hours after extrusion it appears less irregular, shorter and wider (Fig. 1d); within the next hour it becomes cylindrical (Fig. 1e); an hour later it is ovate; and after a further two hours is spherical measuring 0·3 mm across (Fig. 1f). Thus, at a water temperature of 15·5°C., the new-laid egg takes at least eight hours to reach

the printers. There is no *Marginella minutissima* (of any author) listed in Sherborn (up to 1830) but I have not checked the intervening years. However, Tomlin (1917, *Proc. malac. Soc. Lond.* 12, p. 292) lists *pumilio* as the replacement name for *minutissima* but he also failed to find any *Marginella minutissima* Michelin, and there are no prior *M. minutissima.*

'May (1921, Checklist) uses *minutissima,* giving *pumilio* as a synonym and May & Macpherson (1958) also use it. I don't think the reasons for reverting back to *minutissima* have ever been published but I have not carefully checked the literature after about the late 1920's.

'Clearly the only course of action is to revert to *minutissima* Tenison-Woods with *pumilio* as a synonym.'

M. minutissima is minute, average adult specimens measuring only 2·8 × 1·7 × 1·6 mm in length, width and height. Like most prosobranchs it is dioecious but no significant degree of sexual dimorphism is evident externally apart from the presence of a penis in male animals.

The shells are pearly-white, smooth and polished, with the spire involute and a whorl produced above; the aperture is curved and narrow, being only 0·2 mm across at its minimum width.

The animal is a rich orange-yellow; its mantle is smooth and when fully raised over the shell the lobes meet at varying heights on the right side. The siphon and head are represented by a single structure in the form of an open channel with the lateral margins produced into 'tentacles' at the anterior end; a bright-red eye is conspicuous in a swelling on each side (Fig. 1b). The foot lacks an operculum and folds longitudinally on retraction; it is finely ciliated, narrow and tapers posteriorly. The propodium is bifurcate; the sinuation is spanned dorsally by a colourless, bridge-like structure which runs back over the foot to the body wall beneath the labial opening. This structure, presumably a labial palp, is highly contractile and appears to be associated with the extrusion of the proboscis and to assist the propodial lobes in supporting the buccal mass on the host stem during the feeding process: the stem is penetrated and the contents sucked out through the puncture.

Material and Methods

Living specimens of *M. minutissima* were maintained on branches of *A. biseriata* in glass dishes sufficiently shallow for observation, without disturbance, under a stereoscopic microscope. Air bubbles were syringed into the dishes several times a day, and the water changed once a week. Under these conditions, and at an average water temperature of 15·5°C., the molluscs fed, paired, spawned and lived for as long as six months.

Egg capsules, attached to portions of the substrate or detached from it, were maintained separately in small petri dishes. Those deposited in captivity were consistent with those from the field.

Reproduction

Samples of *A. biseriata* examined during all seasons carried egg capsules and juveniles of *M. minutissima* indicating that the species breeds throughout the year.

The spawn consists of individual, ovoid-elongate capsules averaging 1·21 × 0·45 × 0·50 mm in length, width and height; each is transparent, tough-walled, and attached by a narrow base around which is a bordering rim; it is invariably moulded lengthwise over the smooth and convex part of the host stem thus creating a corresponding concavity along the basal plate. Within the capsule is a single red-yolked egg suspended in a colourless albumen contained in a sac which lines

its spherical state in which it remains for about 12 hours before showing signs of cleaving.

The first division is equal, the two resulting blastomeres appearing almost to separate; these also divide equally but the third cleavage is unequal giving rise to four large, red-yolked megameres and four very small, transparent micromeres at the dorsal or animal pole. Spiral cleavage continues with the micromeres spreading over the megameres and a solid, spherical blastula is formed followed by a gastrula stage. Within 10 days the embryo consists of a large, red-coloured cephalic region with two outgrowths of transparent tissue: the ventral one will become the foot and the postero-dorsal one, the visceral mass. The cephalic mass is gradually absorbed as growth and differentiation proceed and finally disappears either just before or shortly after hatching. The velum is suppressed. The early embryo slowly rotates in the albumen, but this rotation ceases as the foot and visceral mass gain in size. After an embryonic period of six to seven weeks the young marginellid almost fills the capsule; its mantle lobes are fully raised over the shell and some general movement is noticeable; it crawls from the capsule which breaks open dorsally, and settles down on the host substrate. This newly-hatched juvenile is a well-developed miniature of the parent with a shell 0·75 mm long; its soft parts are a delicate pale yellow. Specimens were maintained on portions of the host substrate for several months and some growth noted, but the experiment was terminated before the time taken by them to reach maturity had been ascertained.

Pairing was observed in a number of instances, the same procedure pertaining on each occasion. The mating position differs from that usually described for prosobranchs in that the male approaches the posterior end of the mantle cavity of the female. The foot of the female is firmly attached to the substrate and its body pulled forward leaving a spacious posterior mantle cavity; the male mounts the female in a postero-dorsal position from where it passes its long, pointed penis into the mantle cavity at the left of the female, and presumably round the back of the body to the right side in order to reach the genital opening. Mating pairs usually remained in union for several hours, the female being extremely passive and immobile during the entire period.

Polyzoan Host Substrate

Amathia biseriata Krauss, 1837

Amathia inarmata Macgillivray 1886, *Trans. Roy. Soc. Vict.* 23: 183.

This colonial polyzoan ranges from New South Wales through to South Australia and is also recorded from South Africa. In Westernport, Victoria, it is a common species found in water below 10 m and favouring swift-flowing currents; in one instance, near Corinella, colonies were noted in a deep channel at 40 m where the water was muddy and conditions comparatively dark.

Since *M. minutissima* feeds and breeds on *A. biseriata*, it seems plausible to assume that this polyzoan provides an exclusive habitat for the marginellid and perhaps determines its distribution.

A growth series of shells has been placed in the National Museum collection (F26389); also egg capsules containing eggs and embryos (F26390).

Acknowledgements

I am much indebted to Mrs Jeanette Watson who collected the material and provided the field data; to Dr W. F. Ponder who identified the marginellid and traced its taxonomy; to Mrs E. Turner of the Tasmanian Museum, Hobart, for details concerning the holotype; and to Dr Imm. Vigeland of the University of Oslo for his identification of the polyzoan.

My thanks are also due to Dr B. J. Smith of the National Museum of Victoria for reading the manuscript and making helpful suggestions, and to Mr G. J. Browning of the same Museum for the illustrations.

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